

## Outcome of Transforaminal Lumbar Interbody Fusion (TLIF) For Spondylolisthesis of Lumbar Spine

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### ABSTRACT

**Background:** This retrospective study was performed to assess the radiological and clinical outcome of patients who underwent transforaminal lumbar interbody fusion (TLIF) with an interbody cage for spondylolisthesis.

**Methods:** Forty five consecutive patients of spondylolisthesis who underwent transforaminal lumbar interbody fusion (TLIF) during the period from July 2016 to June 2018 were reviewed retrospectively. Clinical data and radiological data were collected and analysed. Twenty seven male and eighteen female patients underwent the TLIF procedure with a mean age of 48.6 years (24–66 years). The primary pathology was a lytic listhesis in 28 patients and degenerative listhesis in 17. There was no multilevel fixation. Two cases were revision surgery. The mean blood loss was 290 ml and mean operative time 160 minutes. No patient need to stay in ICU or HDU. Hospital stay was 4-5 days. Radiological outcome was assessed by observing the presence of fusion mass at biplanar radiography whereas clinical outcomes were assessed by means of the Parker Visual Analog scale (VAS). Results were classified into three categories (excellent and good, fair, and poor) using the Parker criteria. Pain was recorded by using Visual Analog Scale.

**Results:** There were no intra-operative complications. Two patients developed neurological deficit in the form of partial foot drop. There were statistically significant improvements from preoperative VAS to post-operative VAS. Fusion could be assessed in all patients. Anterior interbody fusion was

achieved in 78.3% of cases and posterior lateral fusion was achieved in 69.6%. Four patients showed no fusion at the end of 6 months post operatively.

**Conclusions:** Transforaminal lumbar interbody fusion is a safe and effective method to achieve circumferential fusion. It is technically challenging and needs to be proficient in the technique to avoid catastrophic complications. Clinical scoring confirmed that satisfactory overall outcome. Complications resulting from the procedure is uncommon and generally minor and transient.


**Keywords:** Transforaminal Lumbar Interbody Fusion, Visual Analog Scale, Anterior Interbody Fusion.

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### INTRODUCTION

Transforaminal lumbar interbody fusion (TLIF) is an increasingly more famous remedy for Spondylolisthesis. This technique turned into introduce by Harms and Joeszszky in 1982 as a modification of the posterior lumbar interbody fusion (PLIF) method.<sup>1</sup> As there are dangers to damage the neurological systems due to immoderate retraction on the thecal sac at better stages, Posterior lumbar interbody fusion (PLIF) is confined to stages L3 to S1. It has the extra risks of neural structure mobilisation to facilitate cage insertion. Alternatively, TLIF best calls for a unilateral

technique and accordingly the contralateral side joint and lamina can be preserved which presents a further surface for fusion.<sup>2</sup> On this examine, short term scientific and radiological outcome of Transforaminal lumbar interbody fusion (TLIF) changed into evaluated in lytic and degenerative spondylolisthesis of lumber backbone. This retrospective study was performed to assess the radiological and clinical outcome of patients who underwent transforaminal lumbar interbody fusion (TLIF) with an interbody cage for spondylolisthesis.



Figure 1a: Lumbo-Sacral AP

1b: Lumbo-Sacral LAT

## PATIENTS AND METHODS

Forty five consecutive patients of spondylolisthesis who underwent transforaminal lumbar interbody fusion (TLIF) during the period from July 2016 to June 2018 were reviewed. A retrospective analysis of case notes and imaging was performed. Demographics, presenting symptoms and signs and affected lumbar spinal level were noted. Radiological indications were also noted by assessment of plain films and MRI imaging. Surgical data analysis included operative time, blood loss, technique, intra-operative complications and instrumentation used. Hospital stay and ICU or HDU admission were also documented. All patients completed pre-operative clinical scores. Visual Analogue Scale, were used. The patients were then scored again at 6 months post-op. Clinical scores pre-operatively and at 6 months post-operatively were compared. Statistical significance was assessed by using the student t test. Overall clinical outcomes were assessed by means of the Parker Visual Analog scale (VAS)<sup>3</sup>. Results were classified into three categories (excellent or good, fair, and poor) using the Parker criteria. Pre-operative lateral lumbar spine X-rays were used to measure sagittal alignment for the specific level involved. This was then compared with post-operative lateral films at 6 months' follow-up. Fusion mass was assessed on anterior posterior (AP) and lateral post-operative films at 6 months.

### Technique

A midline approach was used with fluoroscopic confirmation of the level prior to incision. Sub-periosteal dissection was performed and the dissection extended lateral to the transverse processes. Pedicle screws were placed with lateral fluoroscopic control prior to the decompression in order to minimize risk of neurological damage. A portion of bony lamina and facet on the symptomatic side of the affected level were removed. This bone was later used as graft. The nerve roots were identified and retracted. An

annulotomy was performed and the disc removed. To aid the decompression, distracters were placed on the heads of the screws. The endplates were prepared, and auto graft was placed in the anterior disc space prior to insertion of the interbody cage. The cage was packed with auto graft. On introducing the cage the distracters were released prior to rotation and anterior cage placement. The position of the cage was confirmed with fluoroscopy. The contralateral side is instrumented in the same manner, and the laminae and facet joint are decorticated and bone grafted, adding more bed for circumferential fusion. The wound is closed in layers over the suction drainage. Pressure dressings were applied and the patients remained supine for more than 6 hours post-op to prevent a wound hematoma.

### Postoperatively

Patients are allowed mobilization on the first postoperative day in a lumbosacral guide. For the primary 2 weeks sufferers are told for entire bed relaxation then allowed to constrained walk at domestic for another 2 weeks. After one month postoperatively, sufferers are told on a progressive walking program and allowed to go back to habitual sports after 3 months. Sufferers are suggested now not to perform bending or heavy lifting sporting events for at least four–6 months postoperatively. They are then followed up at normal durations with periodic radiographs till the ultimate comply with-up.

## RESULTS

A total of 45 patients were operated during the period from July 2016 to June 2018. 18 female and 27 male patients underwent the procedure with a mean age of 48.6 years (24–66 years). Multilevel fixation was excluded from this study. Single level fixation and fusion was performed at L4-5 in 21 patients, at L5/S1 in 17 patients, at L3/4 in 4 patients and at L2/3 in 3 patients. Among them two cases were revision surgery. The indication for the TLIF

procedure was lytic listhesis (28 patients), and degenerative listhesis (17 patients). The mean blood loss was 290 ml (200–550) and mean operative time 170 min (155–230). No patient need to stay in ICU or HDU.

There were no intra operative complications. Two (4.4%) patient had superficial infection (Stitch infection) which resolved with antibiotics and regular dressing. Three (6.7%) patients had transient parasthesia along the distribution of the exiting root at the level of the surgery which resolved spontaneously over 6 weeks. One patients (2.2%) developed neurological deficit in the form of partial foot drop which gradually improved with Physiotherapy over 3 months. Five patients (11.1%) had radicular pain in the immediate post op that subsided with the use of pregabalin in one to two weeks post operatively. Pain level on a 10-point VAS scale were noted preoperatively and postoperatively during follow up. Mean visual analogue score for back pain was preoperatively  $6.8 \pm 0.721$  and postoperatively after 6 months, it was  $2.6 \pm 0.431$ . Mean visual analogue score for lower limb pain was preoperatively  $7.4 \pm 0.683$  and postoperatively after 6 months, it was  $2.3 \pm 0.569$ . So improvement from preoperative to post operatively after 6 months for back pain and lower limb pain were  $4.2 \pm 0.289$  ( $p < 0.0001$ ) and  $5.1 \pm 0.114$  ( $p < 0.0001$ ) accordingly. No patients reported postoperative pain greater than their preoperative level. Overall clinical outcomes were graded by the Parker criteria. Thirty seven (82%) patients were rated as excellent or good, while 8 (18%) patients were rated as fair, no patient was rated as poor. Biplane radiographs were taken at the follow up on 3 months and 6 months postoperatively. Overall, anterior interbody fusion was achieved in 78.3% of cases and posterior lateral fusion was achieved in 69.6%. Non-union was noted in four patients at 6 months which was on regular followup.

## DISCUSSION

Interbody fusion techniques have won recognition in recent years and feature turn out to be the same old of care to control extraordinary lumbar spinal disorders due to the fact they may be related to higher fusion quotes and higher clinical effects. There are several advantages over posterolateral fusion which include instant anterior column load-sharing reconstruction, better fusion charge, repair disc & foraminal heights and lumbar lordosis<sup>4</sup>. Moreover Postero-lateral fusion cannot address discogenic lower back pain. Interbody fusion can be finished via anterior, posterior, or mixed AP processes. Stand-alone anterior lumbar interbody fusion (ALIF) lets in superb anterior column reconstruction<sup>5, 6</sup>. But it does not allow good enough decompression of the neural structures and is related to the chance for great vessel damage, delayed rehabilitation and venous thromboembolism, retrograde ejaculation in guys, and high failure charge.<sup>7, 8</sup>

Combined AP fixation is often needed to improve the biomechanical properties of the construct however it's far associated with increased blood loss, expanded operative time, improved duration of time inside the ICU, extended hospital stay and price, and -fold-expanded complication rate.<sup>9, 10</sup> Because of these barriers, there was growing hobby in recent years to carry out inter frame fusions from a posterior-best approach. The PLIF procedure has gained popularity, but it requires excessive retraction of the dura out to the midline that may lead to nerve damage, neurogenic pain, and radiculitis and is contraindicated in revision cases with epidural fibrosis. It's miles restricted to L3–S1

levels because of increased hazard for harm to the conus medullaris and cauda equine. PLIF requires a bilateral approach, which increases the operative time, blood loss, and risk for complications.<sup>2</sup> In the TLIF procedure, the angle of approach to the disc space passes through the far lateral portion of the neuroforamen, allowing a unilateral approach to the disc space without excessive dural retraction, minimizing the incidence of nerve damage and pain, decreasing the operative time and bloodloss, and allowing more bed for posterolateral fusion on the contralateral side to achieve circumferential fusion.<sup>4</sup> Humphreys et al<sup>2</sup> alluded to the advantages of TLIF vs PLIF: TLIF could be performed at all lumbar levels, and there was less thecal retraction, operative time and blood loss in TLIF cases compared to PLIF. ALIF is an alternative to TLIF but is associated with great vessel injuries as high as 1.7% and injury to retroperitoneal structures.<sup>11</sup>

In a study of variable level fixation by Jacobsohn<sup>12</sup> showed that mean blood loss 610 ml, mean operative time 170 minutes and hospital stay was on average 7.8 days. In our study we perform single level fixation where mean blood loss 290 ml, mean operative time 160 minutes and hospital stay was 4 to 5 days.

The technique of TLIF is safe and easy in revision cases. It allows entry into the disc space from the far lateral portion of the foramen away from the adhesions and fibrosis in the central canal through a unilateral approach, minimizing the incidence of dural tears and allowing easy repair of any lateral dural tear if it occurred. In the study of Serry and El-Latif<sup>4</sup>, dural tears occurred in two revision cases which were repaired immediately. In the study by Jacobsohn<sup>12</sup> showed no intra operative complication, no unintentional durotomies which is common in PLIF but one patient developed cauda equina syndrome which improved by immediate re-exploration and evaluation of haematoma. Complication rate was 26.7% in the study of Satar et al.<sup>13</sup> But all of them resolved with conservative measures and did not compromise the overall outcome of the procedure. They mention in their study that one (6.7%) patient had superficial infection and resolved with antibiotics, one (6.7%) had deep infection that was late and chronic type, implant removed after bony fusion achieved in that patient. Two (13.3%) of their patients had transient paresthesia also. In our study, there were no intra operative complications. Two (4.4%) patient had superficial infection (Stitch infection) which resolved with antibiotics and regular dressing. Three (6.7%) patients had transient parasthesia along the distribution of the exiting root at the level of the surgery which resolved spontaneously over 6 weeks. One patients (2.2%) developed neurological deficit in the form of partial foot drop which gradually improved with physiotherapy over 3 months. Five patients (11.1%) had radicular pain in the immediate post op that subsided with the use of pregabalin in one to two weeks post operatively.

Clinical and radiological outcome in various studies are encouraging in term of pain reduction and patient satisfaction and radiological solid fusion. In a study by Satar et al<sup>13</sup> showed that pain level improved from a preoperative mean value of  $7.13 \pm 0.743$  to  $2.13 \pm 0.915$  at last follow-up. Lowe et al<sup>14</sup> reported pain improvement from a preoperative mean VAS of  $8.3 \pm 1.97$  to  $3.2 \pm 2.06$  at last follow-up. In painful unstable isthmic spondylolisthesis, the mean preoperative VAS for back pain dropped from 7.3 to 1.6 after surgery and mean preoperative VAS

for leg pain dropped from 8 to 1 after surgery.<sup>15</sup> The study of Poh et al<sup>16</sup> showed Mean VAS for back pain was preoperatively 7.2 and postoperatively after 6 months 2.3 and Mean VAS for lower limb pain was preoperatively 7.8 and postoperatively after 6 months 1.7. Improvement from preoperative to post operatively after 6 months for back pain and lower limb pain were 4.9 and 6.1 accordingly. Serry and El-Latif<sup>4</sup> reported Leg pain improved from  $7.24 \pm 0.61$  to  $2.26 \pm 0.84$  SD postoperatively and to  $0.65 \pm 0.70$  SD at last follow-up, and back pain improved from  $7.78 \pm 0.86$  to  $2.76 \pm 0.89$  SD postoperatively and to  $0.98 \pm 0.75$  SD at last follow-up. In our study Mean VAS for back pain was preoperatively  $6.8 \pm 0.721$  and postoperatively after 6 months  $2.6 \pm 0.431$ . Mean VAS for lower limb pain was preoperatively  $7.4 \pm 0.683$  and postoperatively after 6 months  $2.3 \pm 0.569$ . So improvement from preoperative to post operatively after 6 months for back pain and lower limb pain were  $4.2 \pm 0.289$  ( $p < 0.0001$ ) and  $5.1 \pm 0.114$  ( $p < 0.0001$ ) accordingly.

Weiner et al<sup>17</sup> found a clinical success rate (excellent and good outcomes) in 41% by using the system of Macnab and later modified by McCulloch and An. Their highest success rate (50%) was in lytic listhesis. El Masry et al<sup>18</sup> reported the overall clinical outcome, 90% as excellent or good, while 10% as fair and none of their patient was rated as poor. Satar et al<sup>13</sup> had applied the parker criteria in their study to describe their overall outcome where 80% were excellent or good, while 20% were fair and none was poor. In our study overall clinical outcomes were also graded by the Parker criteria. Thirty seven (82%) patients were rated as excellent or good, while 8 (18%) patients were rated as fair, no patient was rated as poor.

In the study of Lowe et al<sup>14</sup>, good to excellent clinical results were achieved in 79% of patients and solid radiographic fusion was found in 90% of patients.

Salehi et al<sup>19</sup> reported 92% solid radiologic fusions and satisfactory outcomes in the majority of patients using the modified Prolo scores. In the study by Serry and El-Latif<sup>4</sup> mentioned solid radiographic fusion was averaged 90% and satisfactory clinical outcomes were achieved in all patients using the ODI questionnaire.

Jacobsohn<sup>12</sup> reported a study of 52 cases with long term follow up and found 47 patients had fusion. In their study, anterior interbody fusion was achieved in 95.3% of cases and posterior lateral fusion was achieved in 83.7%. In our study overall anterior interbody fusion was achieved in 78.3% of cases and posterior lateral fusion was achieved in 69.6%. Non-union was noted in four patients at 6 months which was on regular follow up.

Even though surgical strategies now tend toward the minimally invasive approach, traditional open TLIF may be performed with much less surgical trauma using brief incision after careful levelling using fluoroscopy and care in muscle stripping, minimizing gentle tissue trauma and keeping off damage to the nearby aspect capsule.

Unilateral TLIF preserves the inter-spinous and supraspinous ligaments for later muscle attachment, and the contralateral facet and lamina, minimizing posterior destabilization and allowing circumferential fusion. It preserves the anterior and maximum of the posterior longitudinal ligaments, which offers a anxiety band for compression and prevention of repulsion of the graft. It avoids smooth tissue dissection within the spinal canal, which may additionally help save you scarring and instability of adjoining

segments in addition to the exiting nerve root. By using using and maintaining the bony attachment sites of the lumbar backbone, unilateral TLIF can quicken and improve the affected person's healing.

## CONCLUSION

Transforaminal lumbar interbody fusion is a easy, powerful and strong technique that achieves precise useful and radiological outcomes in Spondylolisthesis with top patient delight. it is secure and reliable in sufferers however technically tough. Medical records proved that our sufferers did benefit considerably with this Transforaminal lumbar interbody fusion (TLIF) approach.

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